ACCREDITED
TESTING LABORATORY
CERTIFICATE #4820.01

BACL
Bay Area Compliance Labs Corp.

FCC PART 15.247

TEST REPORT

For

Shenzhen WFLY Technology Development Co.,Ltd.

C2 Building, 4th Floor, Xiangli Industrial Park, Hepinghaoye Road, Fuyong Street, Bao'an District,Shenzhen City,Guangdong Province,China

FCC ID: TZVRF209S

Report Type: Original Report	**Product Name:** Wireless digital model remote control receiver

Report Number:	RDG191220009-00
Report Date:	2020-03-04
Reviewed By:	Ivan Cao Assistant manager
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	Wireless digital model remote control receiver
EUT Model:	RF209S
Multiple Models:	RF207S,RF206S,RF204W,RF201S
Operation Frequency:	2402-2470 MHz
Maximum Peak Output Power (Conducted):	18.12 dBm
Modulation Type:	GFSK
Rated Input Voltage:	DC 13V from battery
Serial Number:	RDG191220009-RF-S3
EUT Received Date:	2019.12.23
EUT Received Status:	Good

Note: This series products model: RF209S and RF207S,RF206S,RF204W,RF201S *are electrically identical. Model RF209S was selected for fully testing and the detailed information can be referred to the declaration.*

Objective

This report is prepared on behalf of Shenzhen WFLY Technology Development Co.,Ltd. in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules

The tests were performed in order to determine the EUT compliance with FCC Rules Part 15, Subpart C, and section 15.203, 15.205, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

Part of system submissions with FCC ID: TZVET06

Test Methodology

All measurements detailed in this Test Report were performed in accordance with ANSI C63.10-2013 "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices".

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
Power Spectral Density, conducted	±0.61 dB
Unwanted Emissions, radiated	30M~200MHz: 4.55 dB,200M~1GHz: 5.92 dB,1G~6GHz: 4.98 dB, 6G~18GHz: 5.89 dB,18G~26.5G:5.47 dB,26.5G~40G:5.63 dB
Unwanted Emissions, conducted	±1.5 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol "△ ". Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

This report cannot be reproduced except in full, without prior written approval of the Company.

This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA, or any agency of the U.S. Government.

This report may contain data that are not covered by the accreditation scope and shall be marked with an asterisk "★".

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in engineering mode.

The device employs 69 channels as below, and select 64 frequency hopping channels randomly for use.

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	**2402**	19	2420	37	2438	55	2456
2	2403	20	2421	38	2439	56	2457
3	2404	21	2422	39	2440	57	2458
4	2405	22	2423	40	2441	58	2459
5	2406	23	2424	41	2442	59	2460
6	2407	24	2425	42	2443	60	2461
7	2408	25	2426	43	2444	61	2462
8	2409	26	2427	44	2445	62	2463
9	2410	27	2428	45	2446	63	2464
10	2411	28	2429	46	2447	64	2465
11	2412	29	2430	47	2448	65	2466
12	2413	30	2431	48	2449	66	2467
13	2414	31	2432	49	2450	67	2468
14	2415	32	2433	50	2451	68	2469
15	2416	33	2434	51	2452	**69**	**2470**
16	2417	34	2435	52	2453	/	/
17	2418	35	2436	53	2454	/	/
18	2419	**36**	**2437**	54	2455	/	/

EUT was tested with channel 1, 36 and 69.

The device have two antenna port, and the system select one chain for Tx and Rx base on good perfemance determined by the system.

EUT Exercise Software

No software was used in test, the EUT was set to engineering mode by manufacturer and swith test mode and power level by remote controller as below table:, which was provided by manufacturer.

Antenna Port	Channel	Frequency (MHz)	Power Level
Chain 1	Low	2402	18
	Middle	2437	18
	High	2470	18
Chain 2	Low	2402	18
	Middle	2437	18
	High	2470	18

Equipment Modifications

No modification was made to the EUT.

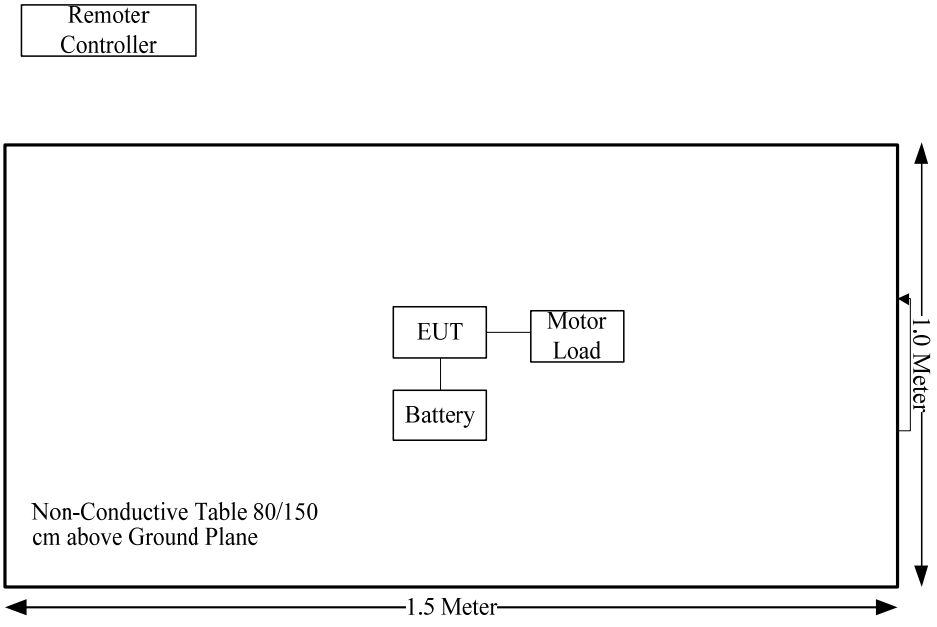
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
WFLY	Remote Controller	ET06	/
WFLY	Motor	Un-known	/
WFLY	Battery	Un-known	/

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Power Cable	No	No	0.05	Battery	EUT
Power Cable	No	No	0.10	Battery	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC§15.247 (i) & §1.1310 & §2.1091	Maximum Permissible Exposure (MPE)	Compliance
FCC §15.203	Antenna requirement	Compliance
FCC §15.207(a)	AC line conducted emissions	Not Applicable
FCC §15.205, §15.209, §15.247(d)	Spurious emissions	Compliance
FCC §15.247(a)(1)	Channel separation	Compliance
FCC §15.247(a)(1)	20 dB bandwidth	Compliance
FCC §15.247(a)(1)(iii)	Quantity of hopping channel test	Compliance
FCC §15.247(a)(1)(iii)	Time of occupancy (dwell time)	Compliance
FCC §15.247(b)(1)	Peak output power measurement	Compliance
FCC §15.247(d)	Band edges	Compliance

Not Applicable: the device was powered by battery when use.

FCC §15.247 (i) & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247(i)and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f²)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculation formula:

Prediction of power density at the distance of the applicable MPE limit
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

Frequency (MHz)	**Antenna Gain**		**Conducted output power including Tune-up Tolerance**		**Evaluation Distance (cm)**	**Power Density (mW/cm^2)**	**MPE Limit (mW/cm^2)**
	(dBi)	**(numeric)**	**(dBm)**	**(mW)**			
2402-2470	2	1.58	19	79.43	20.00	0.03	1.0

Result: The device meet FCC MPE at 20 cm distance

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Antenna Connector Construction

The EUT has two antenna uses unique coupling to the intentional radiator, fulfill the requirement of this section. Please refer to below information and the EUT photos:

Antenna Type	input impedance (Ohm)	Antenna Gain /Frequency Range
Monopole	50	2 dBi/2.4~2.5GHz

Result: Compliance.

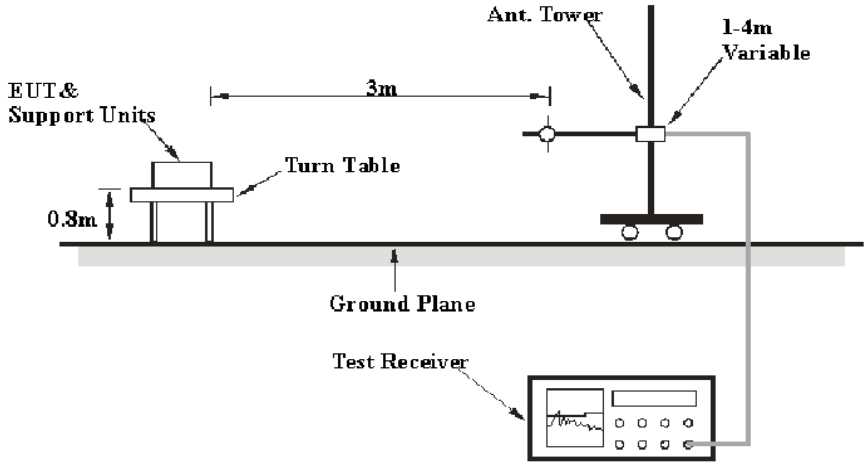
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

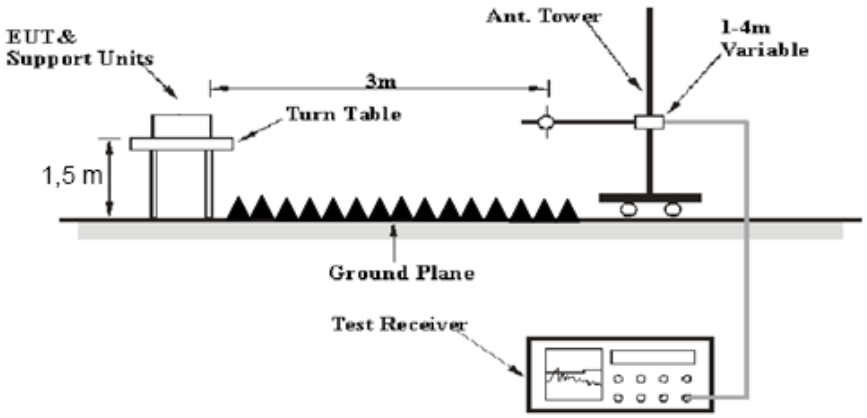
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission below 1GHz tests were performed in the 10 meters chamber, above 1GHz tests were performed in the 3 meters chamber B, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

According to FCC public notice: DA-00-705, during the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	AV

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz - 1 GHz, peak and average detection modes for frequencies above 1 GHz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiation Below 1GHz					
R&S	EMI Test Receiver	ESCI	100035	2019-08-03	2020-08-03
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Sunol Sciences	Antenna	JB3	A060611-2	2017-08-25	2020-08-25
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-02	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0530-01	2019-09-24	2020-09-24
Sonoma	Amplifier	310N	185914	2019-10-13	2020-10-13
Radiation Above 1GHz					
Agilent	Spectrum Analyzer	E4440A	SG43360054	2019-05-09	2020-05-09
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-01 1304	2019-11-18	2022-11-18
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-2.4J2.4J-50	C-0700-02	2019-06-27	2020-06-27
Mini-Circuit	Amplifier	ZVA-213-S+	54201245	2019-09-05	2020-09-05
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2019-06-27	2020-06-27
E-Microwave	Band-stop Filters	OBSF-2400-2483.5-S	OE01601525	2019-06-16	2020-06-16
Micro-tronics	High Pass Filter	HPM50111	S/N-G217	2019-06-16	2020-06-16

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Data

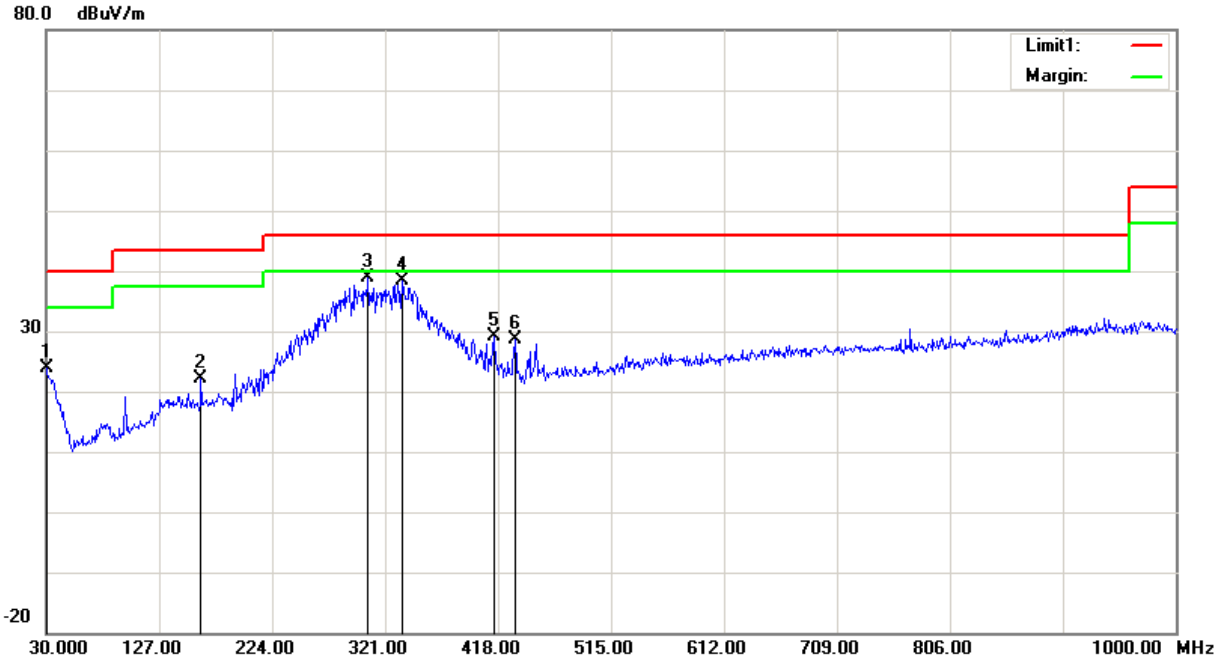
Environmental Conditions

Test Items	Radiation Below 1GHz	Radiation Above 1GHz
Temperature:	24.3°C	24.2°C
Relative Humidity:	44%	39 %
ATM Pressure:	102.5 kPa	102.5 kPa
Tester:	Felix Zhang	Jackson Zhang
Test Date:	2019-12-26	2019-12-26

Test Mode: Transmitting(Chain 2 was the worst and reported)

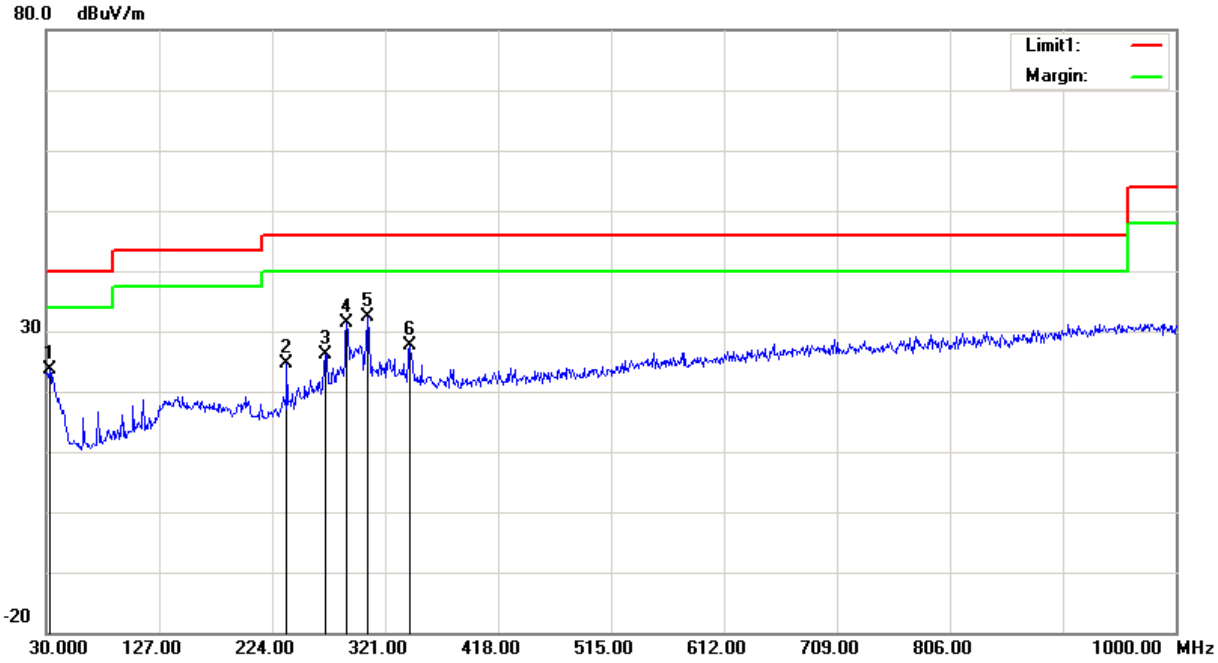
1) 30MHz-1GHz (BDR Low channel was the worst)

Horizontal:



Frequency (MHz)	Receiver Reading (dBµV)	Remark	Correction Factor (dB/m)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30.0000	28.11	peak	-4.33	23.78	40.00	16.22
162.8900	31.64	peak	-9.53	22.11	43.50	21.39
306.4500	46.18	peak	-7.19	38.99	46.00	7.01
335.5500	45.29	peak	-6.90	38.39	46.00	7.61
414.1200	33.97	peak	-4.86	29.11	46.00	16.89
432.5500	33.33	peak	-4.59	28.74	46.00	17.26

Vertical:



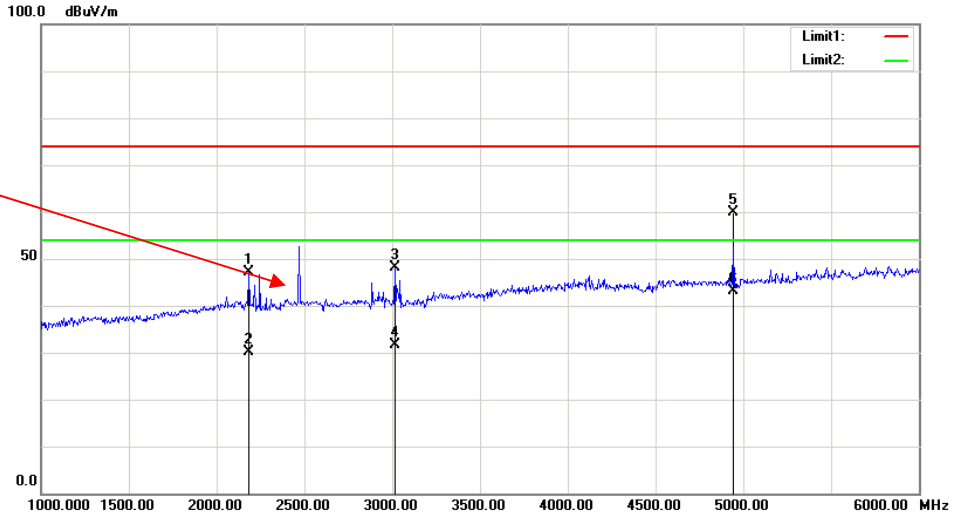
Frequency (MHz)	Receiver Reading (dBµV)	Remark	Correction Factor (dB/m)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
32.9100	29.43	peak	-5.92	23.51	40.00	16.49
236.6100	34.71	peak	-10.19	24.52	46.00	21.48
269.5900	35.05	peak	-8.87	26.18	46.00	19.82
288.0200	39.78	peak	-8.31	31.47	46.00	14.53
305.4800	39.62	peak	-7.22	32.40	46.00	13.60
342.3400	34.46	peak	-6.71	27.75	46.00	18.25

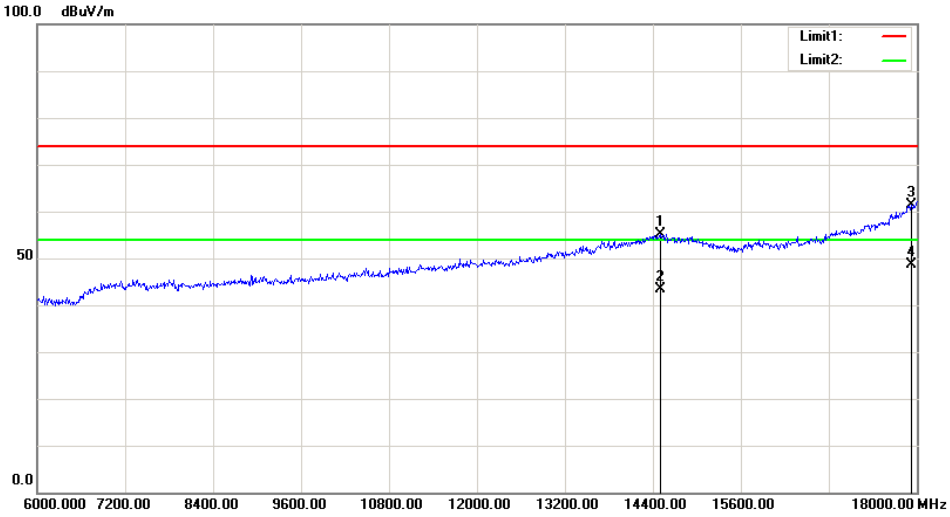
2)1GHz-25GHz*:*

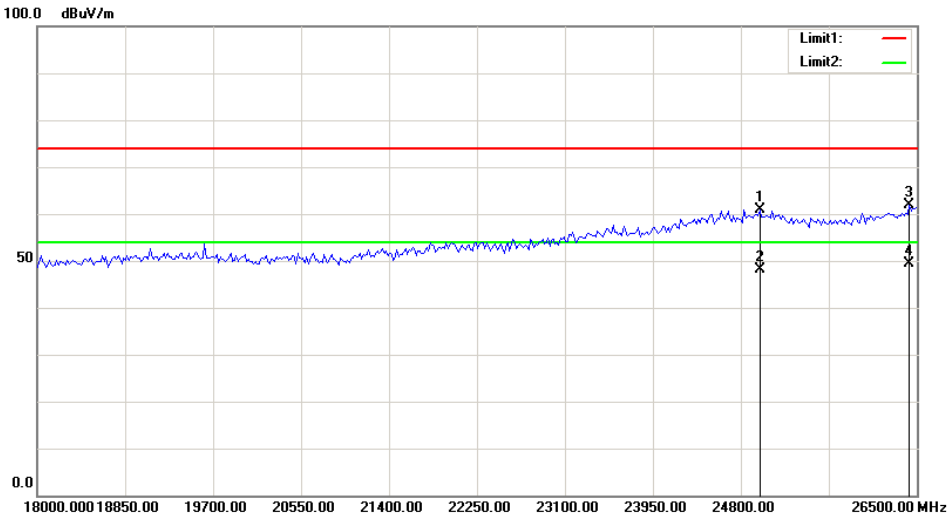
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Remark	Polar (H/V)	Factor (dB/m)					
Low Channel: 2402 MHz									
2402.00	82.06	PK	H	28.10	1.80	0.00	111.96	N/A	N/A
2402.00	63.80	AV	H	28.10	1.80	0.00	93.70	N/A	N/A
2402.00	75.96	PK	V	28.10	1.80	0.00	105.86	N/A	N/A
2402.00	57.67	AV	V	28.10	1.80	0.00	87.57	N/A	N/A
2390.00	43.16	PK	H	28.08	1.80	0.00	73.04	74.00	0.96
2390.00	14.52	AV	H	28.08	1.80	0.00	44.40	54.00	9.60
4804.00	48.87	PK	H	32.91	3.17	25.60	59.35	74.00	14.65
4804.00	31.89	AV	H	32.91	3.17	25.60	42.37	54.00	11.63
7206.00	43.78	PK	H	35.74	4.82	25.60	58.74	74.00	15.26
7206.00	27.34	AV	H	35.74	4.82	25.60	42.30	54.00	11.70
2185.00	43.12	PK	H	27.67	1.74	25.58	46.95	74.00	27.05
2185.00	26.22	AV	H	27.67	1.74	25.58	30.05	54.00	23.95
3015.00	41.36	PK	H	30.14	2.15	26.03	47.62	74.00	26.38
3015.00	25.23	AV	H	30.14	2.15	26.03	31.49	54.00	22.51
Middle Channel: 2437 MHz									
2437.00	84.23	PK	H	28.17	1.82	0.00	114.22	N/A	N/A
2437.00	61.18	AV	H	28.17	1.82	0.00	91.17	N/A	N/A
2437.00	77.43	PK	V	28.17	1.82	0.00	107.42	N/A	N/A
2437.00	54.31	AV	V	28.17	1.82	0.00	84.30	N/A	N/A
4874.00	49.03	PK	H	33.05	3.26	25.65	59.69	74.00	14.31
4874.00	32.11	AV	H	33.05	3.26	25.65	42.77	54.00	11.23
7311.00	45.28	PK	H	36.01	4.64	25.71	60.22	74.00	13.78
7311.00	28.75	AV	H	36.01	4.64	25.71	43.69	54.00	10.31
2185.00	43.15	PK	H	27.67	1.74	25.58	46.98	74.00	27.02
2185.00	26.02	AV	H	27.67	1.74	25.58	29.85	54.00	24.15
3015.00	41.25	PK	H	30.14	2.15	26.03	47.51	74.00	26.49
3015.00	25.19	AV	H	30.14	2.15	26.03	31.45	54.00	22.55
High Channel: 2470 MHz									
2470.00	85.54	PK	H	28.24	1.84	0.00	115.62	N/A	N/A
2470.00	62.27	AV	H	28.24	1.84	0.00	92.35	N/A	N/A
2470.00	78.63	PK	V	28.24	1.84	0.00	108.71	N/A	N/A
2470.00	55.34	AV	V	28.24	1.84	0.00	85.42	N/A	N/A
2483.50	42.37	PK	H	28.27	1.84	0.00	72.48	74.00	1.52
2483.50	14.82	AV	H	28.27	1.84	0.00	44.93	54.00	9.07
4940.00	49.12	PK	H	33.18	3.25	25.64	59.91	74.00	14.09
4940.00	32.31	AV	H	33.18	3.25	25.64	43.10	54.00	10.90
7410.00	47.29	PK	H	36.27	4.47	25.82	62.21	74.00	11.79
7410.00	30.22	AV	H	36.27	4.47	25.82	45.14	54.00	8.86
2185.00	43.26	PK	H	27.67	1.74	25.58	47.09	74.00	26.91
2185.00	26.36	AV	H	27.67	1.74	25.58	30.19	54.00	23.81
3015.00	41.49	PK	H	30.14	2.15	26.03	47.75	74.00	26.25
3015.00	25.43	AV	H	30.14	2.15	26.03	31.69	54.00	22.31

Worst plots (high channel was the worst**)**
Horizontal

Fundamental Test with Band Rejection Filter

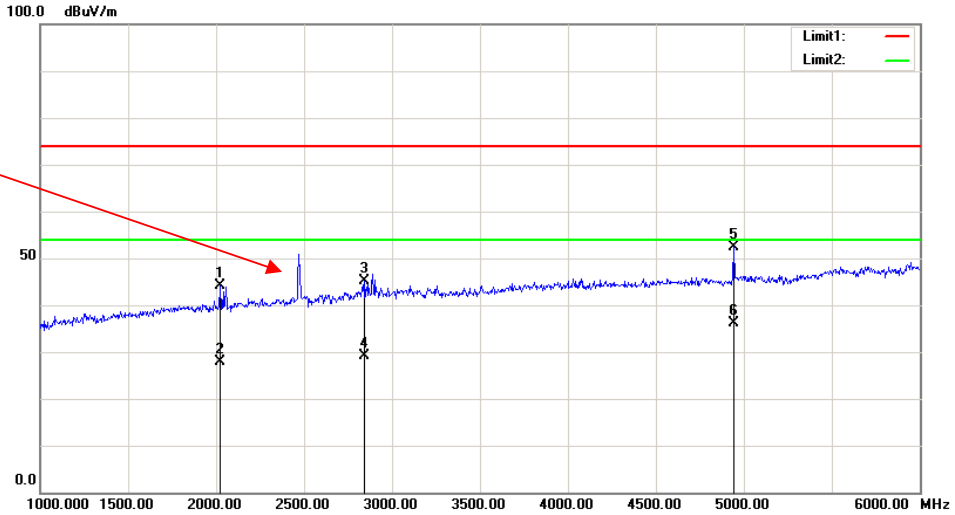


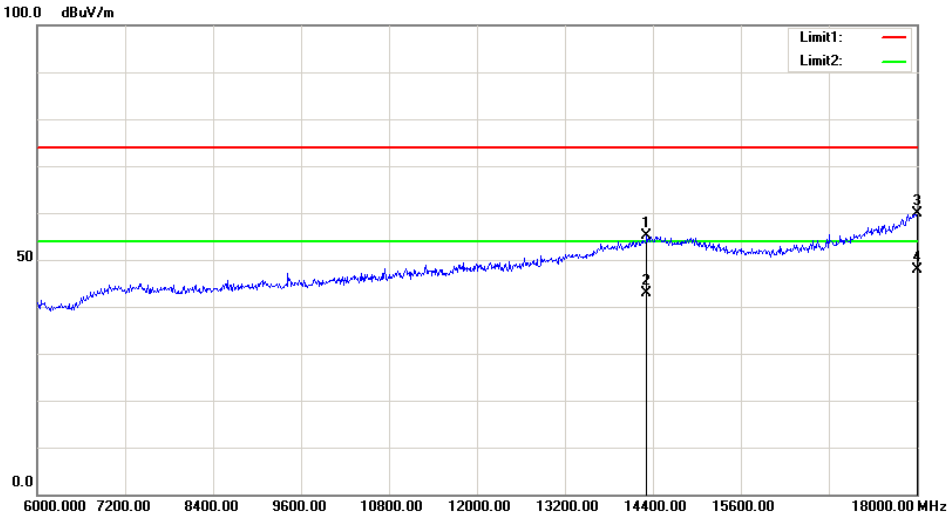


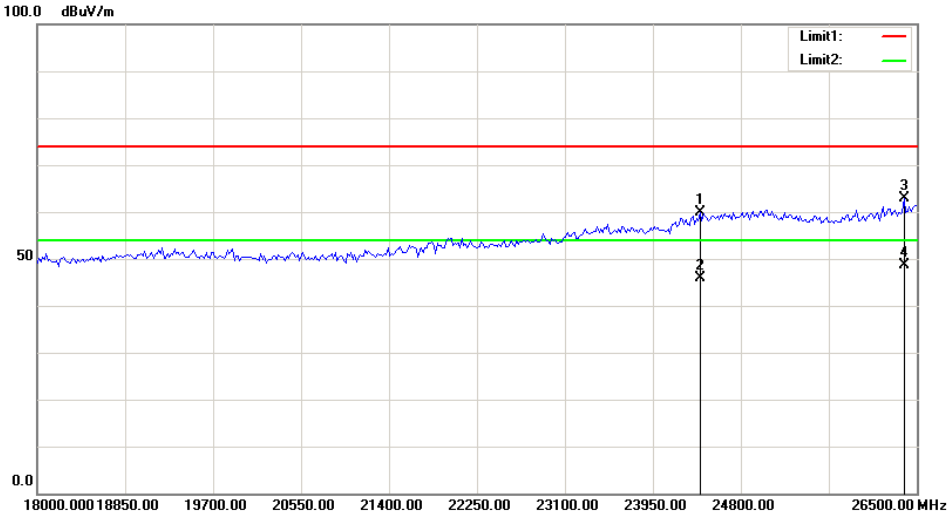


Vertical

Fundamental Test with Band Rejection Filter







FCC §15.247(a) (1) - CHANNEL SEPARATION TEST

Applicable Standard

Frequency hopping systems shall have hoping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.50 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2019-05-09	2020-05-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	Each time	N/A

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Procedure

1. Set the EUT in transmitting mode, spectrum Bandwidth was set at 30 kHz, maxhold the channel.
2. Set the adjacent channel of the EUT maxhold another trace.
3. Measure the channel separation.

Test Data

Environmental Conditions

Temperature:	23.7～26.4°C
Relative Humidity:	39～64%
ATM Pressure:	101.6～102.6 kPa
Test by:	Chris Mo
Test Date:	2019-12-24～2020-01-06

Test Result: Compliance.

Please refer to following tables and plots

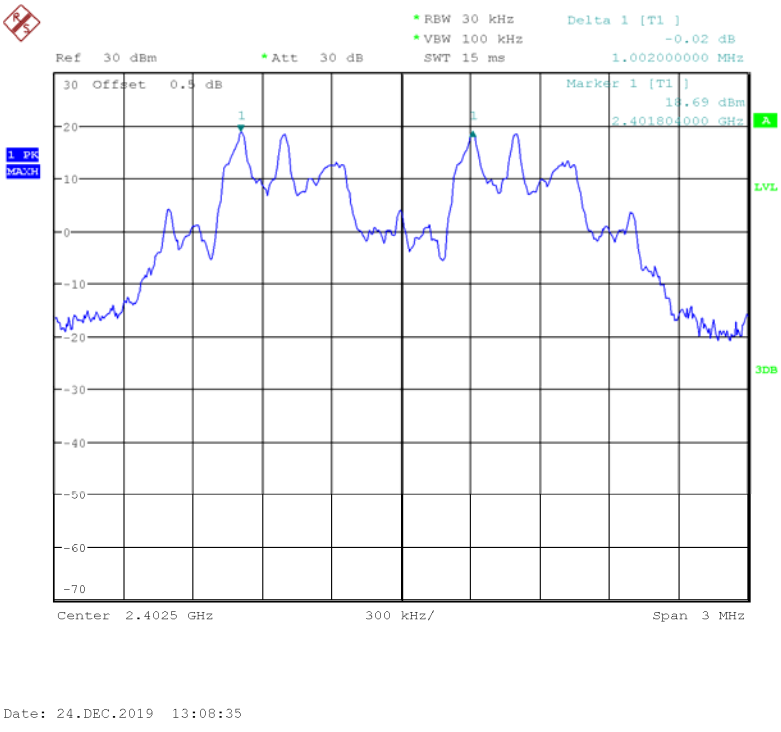
Test Mode: Transmitting

Antenna	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
Chain 1	Low	2402	1.002	0.69
	Middle	2437	1.002	0.69
	High	2470	1.002	0.69
Chain 2	Low	2402	1.002	0.69
	Middle	2437	1.002	0.68
	High	2470	1.004	0.69

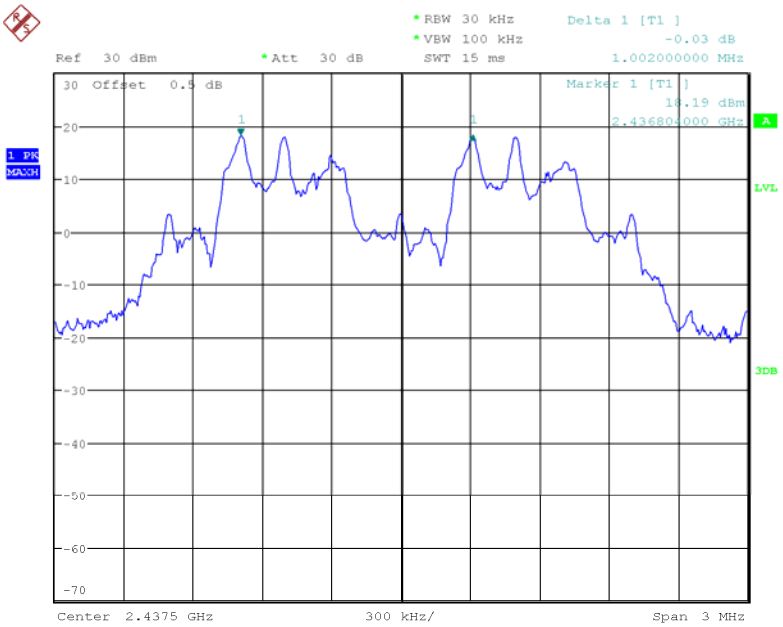
Note: Limit= (2/3) × 20dB bandwidth

Chain 1:

Low Channel

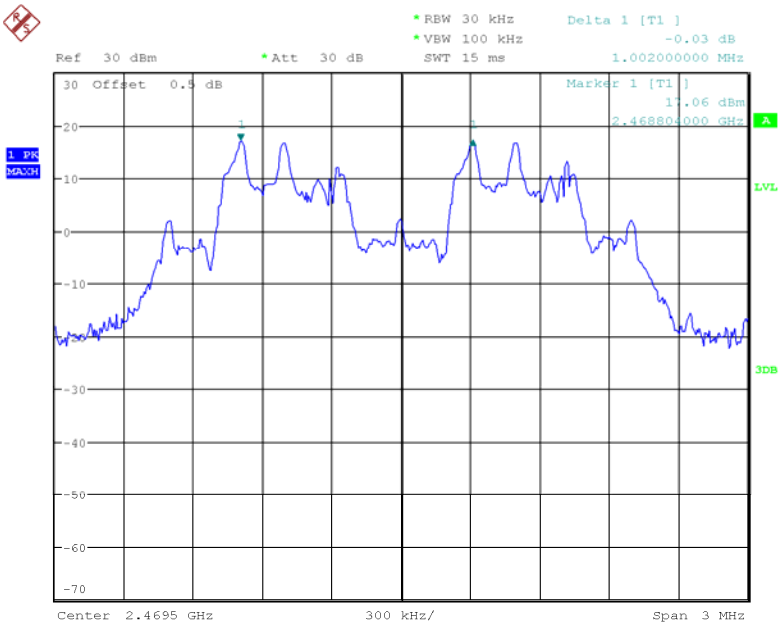


Middle Channel



Date: 24.DEC.2019 13:12:40

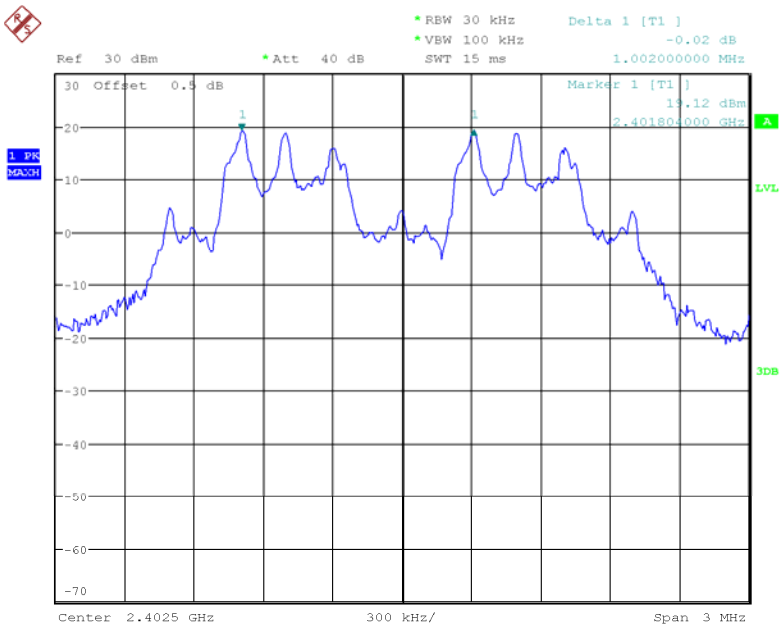
High Channel



Date: 6.JAN.2020 16:39:32

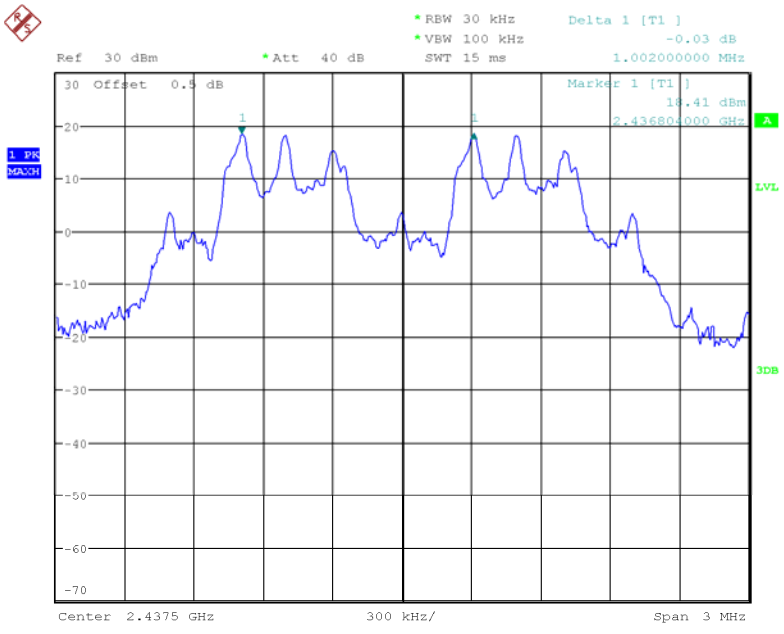
Chain 2:

Low Channel



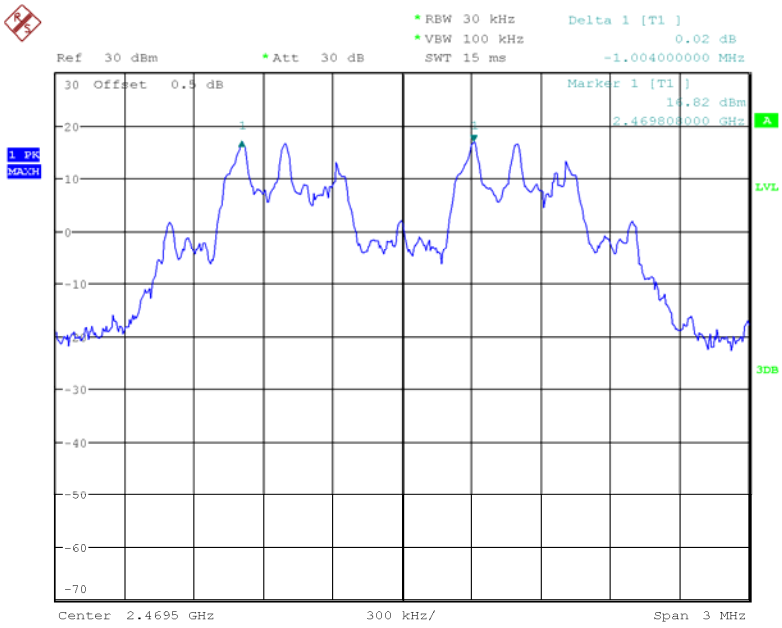
Date: 25.DEC.2019 09:54:36

Middle Channel



Date: 25.DEC.2019 09:55:47

High Channel



Date: 6.JAN.2020 16:59:15

FCC §15.247(a) (1) – 20 dB BANDWIDTH TESTING

Applicable Standard

Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2019-05-09	2020-05-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	Each time	N/A

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	23.7～26.4°C
Relative Humidity:	39～64%
ATM Pressure:	101.6～102.6 kPa
Test by:	Chris Mo
Test Date:	2019-12-24～2020-01-06

Test Result: Compliance.

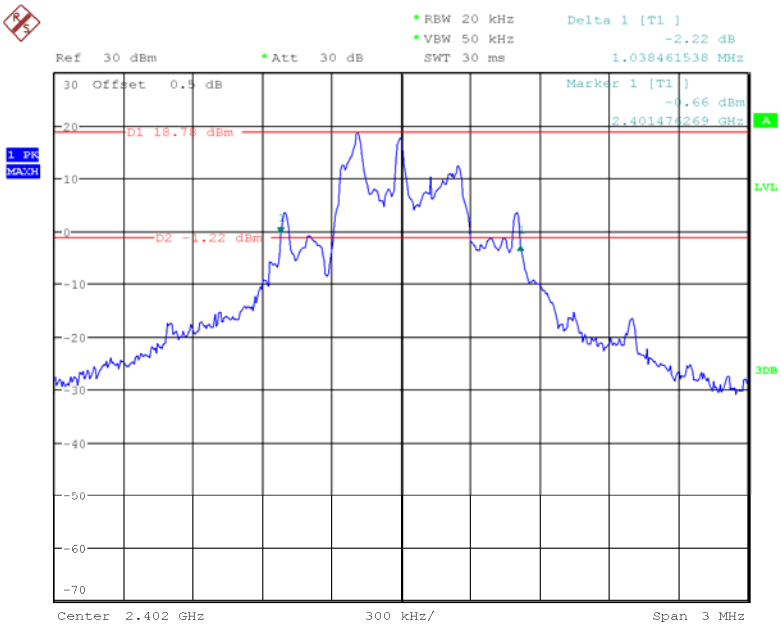
Please refer to following tables and plots

Test Mode: Transmitting

Antenna	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Chain 1	Low	2402	1.038
	Middle	2437	1.038
	High	2470	1.038
Chain 2	Low	2402	1.038
	Middle	2437	1.019
	High	2470	1.038

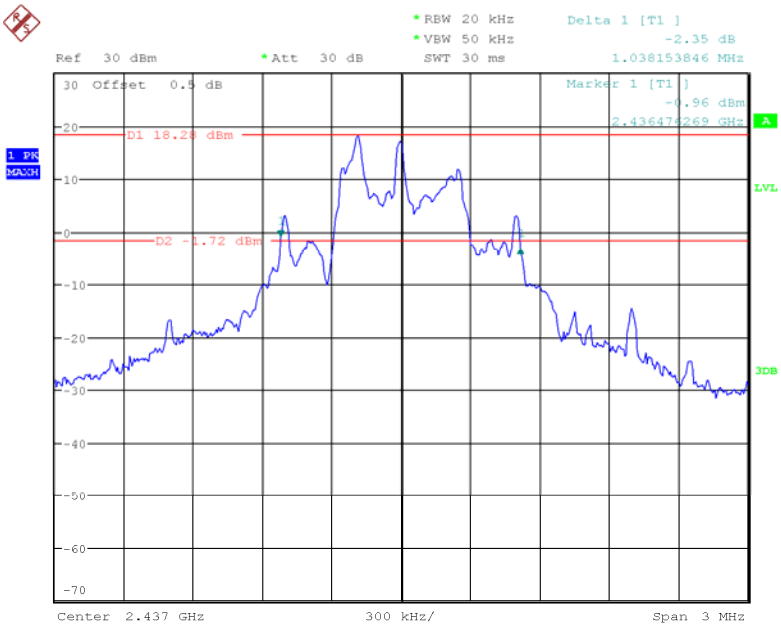
Chain 1:

Low Channel



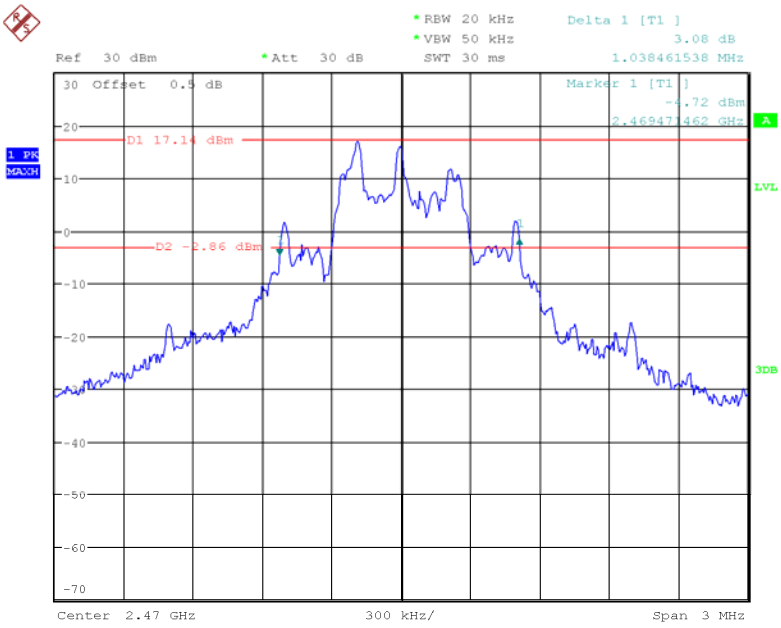
Date: 24.DEC.2019 11:59:00

Middle Channel



Date: 24.DEC.2019 13:02:08

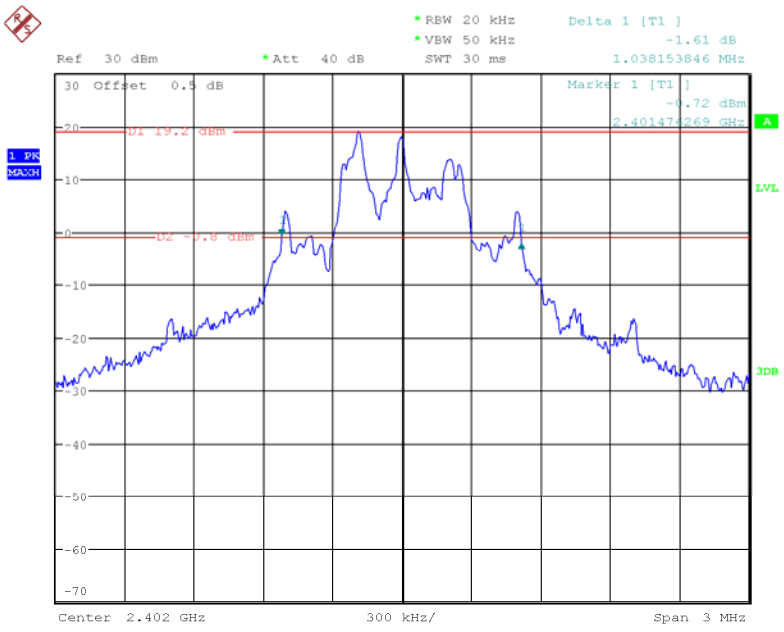
High Channel



Date: 6.JAN.2020 16:29:21

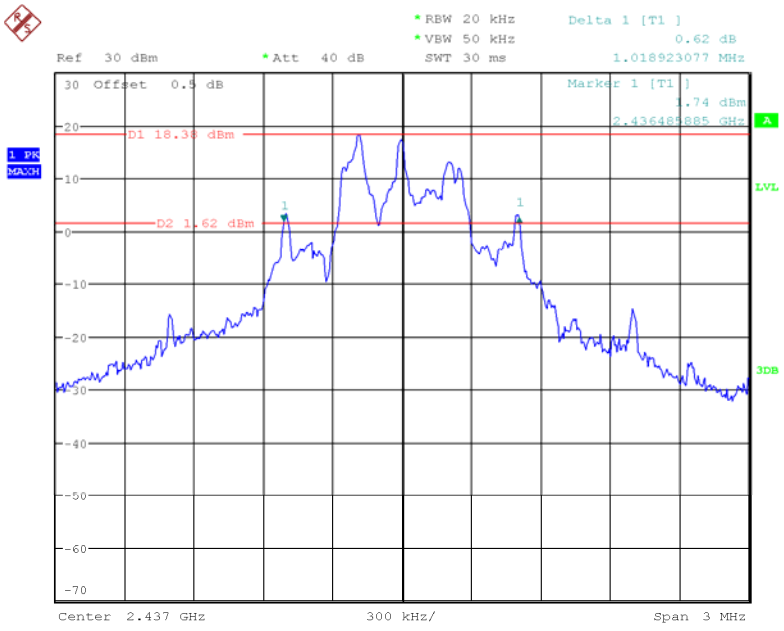
Chain 2:

Low Channel



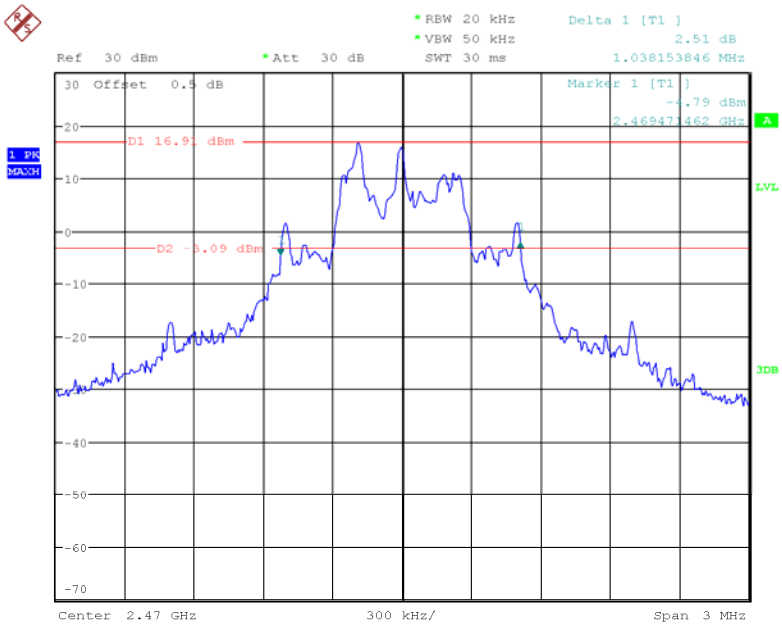
Date: 25.DEC.2019 10:00:57

Middle Channel



Date: 25.DEC.2019 09:59:42

High Channel



Date: 6.JAN.2020 16:56:03

FCC §15.247(a) (1) (iii) - QUANTITY OF HOPPING CHANNEL TEST

Applicable Standard

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

2. Set the EUT in hopping mode from first channel to last.

3. By using the Max-Hold function record the Quantity of the channel.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2019-05-09	2020-05-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	Each time	N/A

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	23.7～26.4°C
Relative Humidity:	39～64%
ATM Pressure:	101.6～102.6 kPa
Test by:	Chris Mo
Test Date:	2019-12-25～2020-01-06

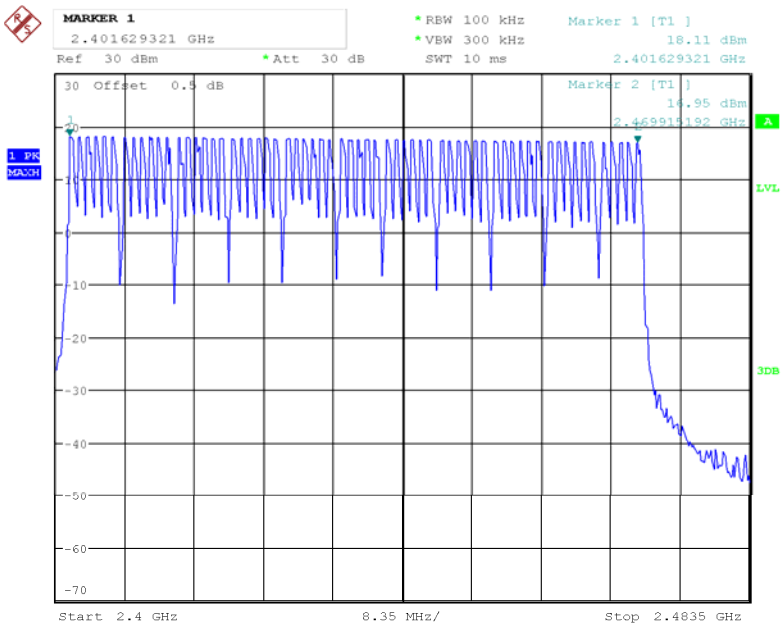
Test Result: Compliance.

Please refer to following tables and plots

Test Mode: Transmitting

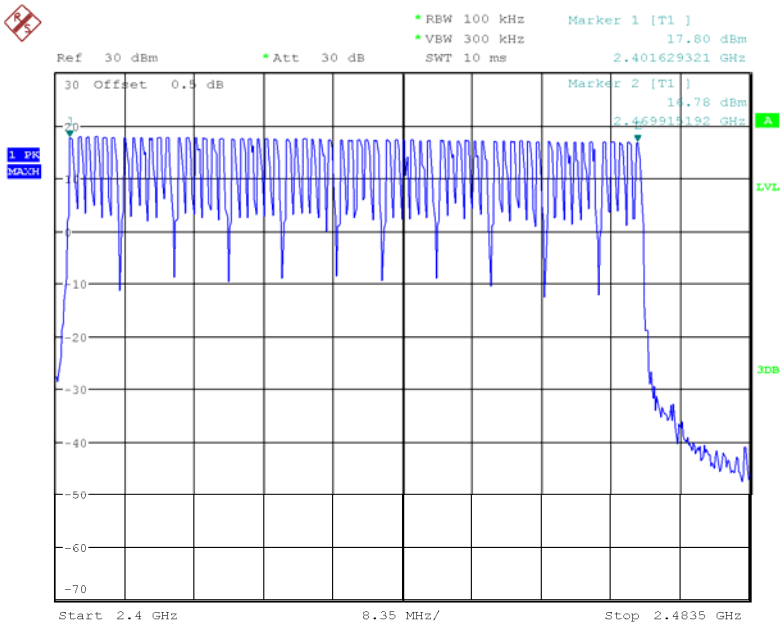
Antenna	Frequency Range (MHz)	Number of Hopping Channel	Limit
Chain 1	2400-2483.5	64	≥15
Chain 2	2400-2483.5	64	≥15

Chain 1



Date: 6.JAN.2020 16:42:59

Chain 2



Date: 6.JAN.2020 16:46:56

FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME)

Applicable Standard

Frequency hopping systems in the 2400-2483.5 MHz shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

The EUT was worked in channel hopping; the time of single pulses was tested.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2019-05-09	2020-05-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	Each time	N/A

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	19.7～26.4°C
Relative Humidity:	37～73%
ATM Pressure:	101.2～102.6 kPa
Test by:	Chris Mo
Test Date:	2019-12-24～2020-03-04

Test Result: Compliance.

Please refer to following tables and plots

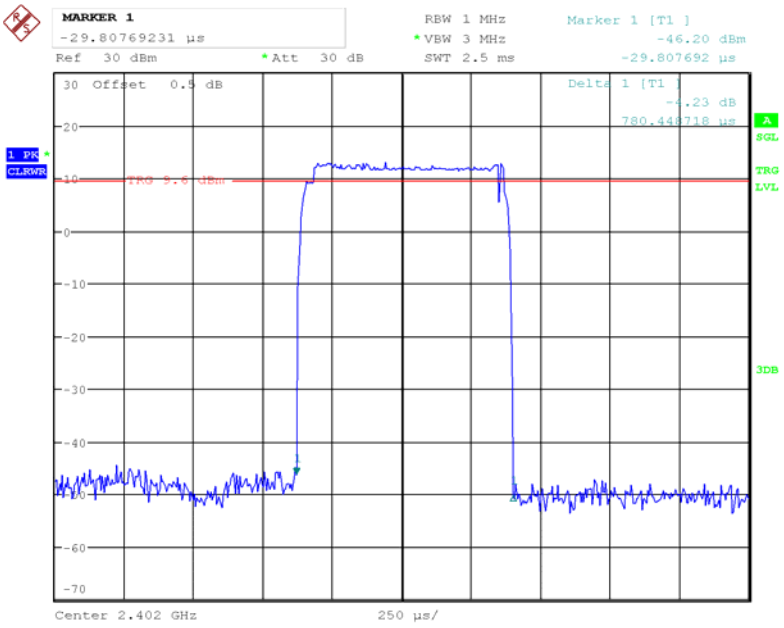
Test Mode: Transmitting

Antenna Chain	Channel	Frequency (MHz)	Puse width (ms)	hopping number within the Priod	Result (s)	Limit (s)
1	Low	2402	0.780	74	0.058	0.4
2	Low	2402	0.780	73	0.057	0.4

Note: The test result = Time per one hopping (Pulse width) * hopping number (within the time obtained by multiplying the hopping channel number by 0.4s)

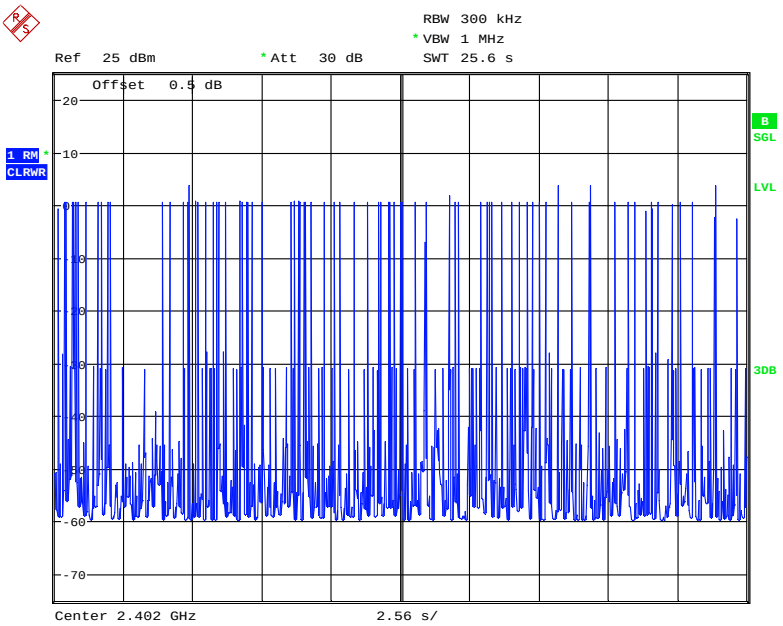
Chain 1

Pulse Width



Date: 24.DEC.2019 13:20:04

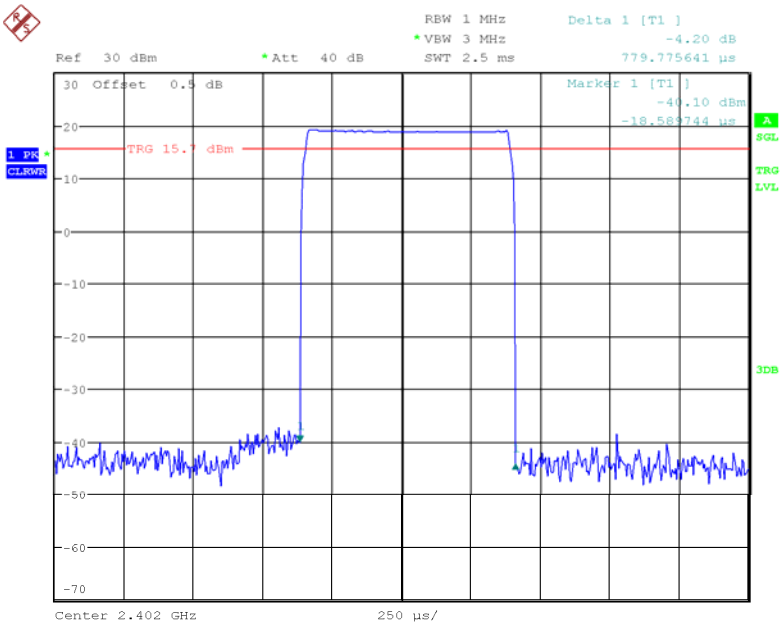
hopping numbers



Date: 4.MAR.2020 14:48:02

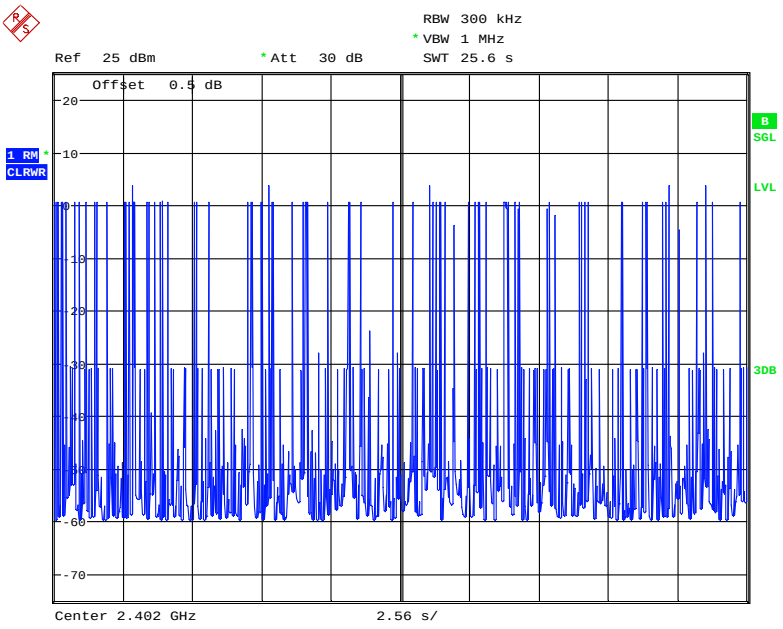
Chain 2

Pulse Width



Date: 25.DEC.2019 09:36:00

hopping numbers



Date: 4.MAR.2020 14:52:18

FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

According to §15.247(b) (1), for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts

Test Procedure

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	Each time	N/A
Agilent	USB Wideband Power Sensor	U2021XA	MY5425009	2019-05-09	2020-05-09

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	23.7～26.4°C
Relative Humidity:	39～64%
ATM Pressure:	101.6～102.6 kPa
Test by:	Chris Mo
Test Date:	2019-12-25～2020-01-06

Test Result: Compliance.

Test Mode: Transmitting

Antenna	Frequency (MHz)	Peak Conducted Output power (dBm)	Limit (dBm)
Chain 1	2402	18.02	21
	2437	17.47	21
	2470	17.20	21
Chain 2	2402	18.12	21
	2437	17.50	21
	2470	16.89	21

Note: The data above was tested in conducted mode.

FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW/ VBW of spectrum analyzer to 100/300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2019-05-09	2020-05-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	Each time	N/A

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

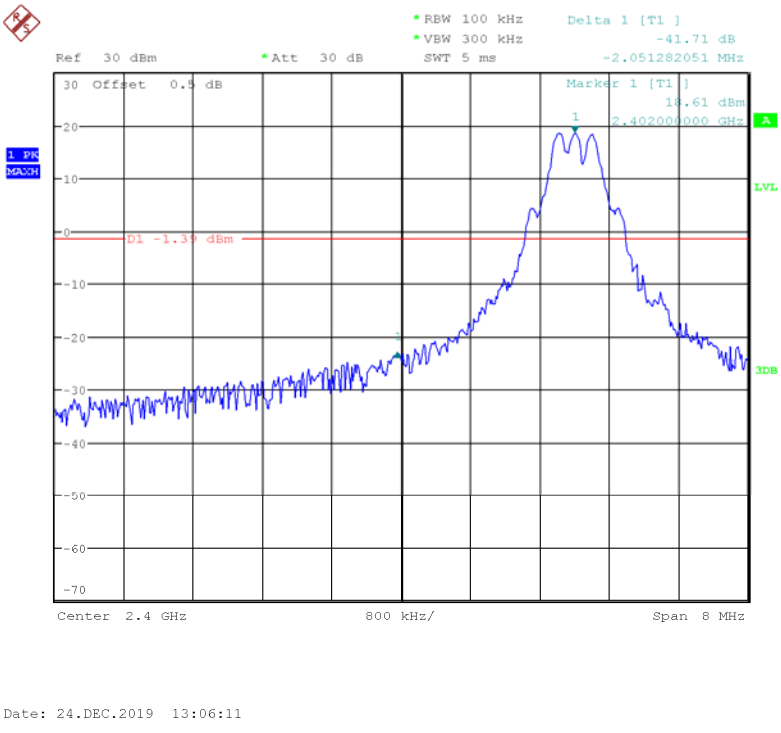
Environmental Conditions

Temperature:	23.7～26.4°C
Relative Humidity:	39～64%
ATM Pressure:	101.6～102.6 kPa
Test by:	Chris Mo
Test Date:	2019-12-25～2020-01-06

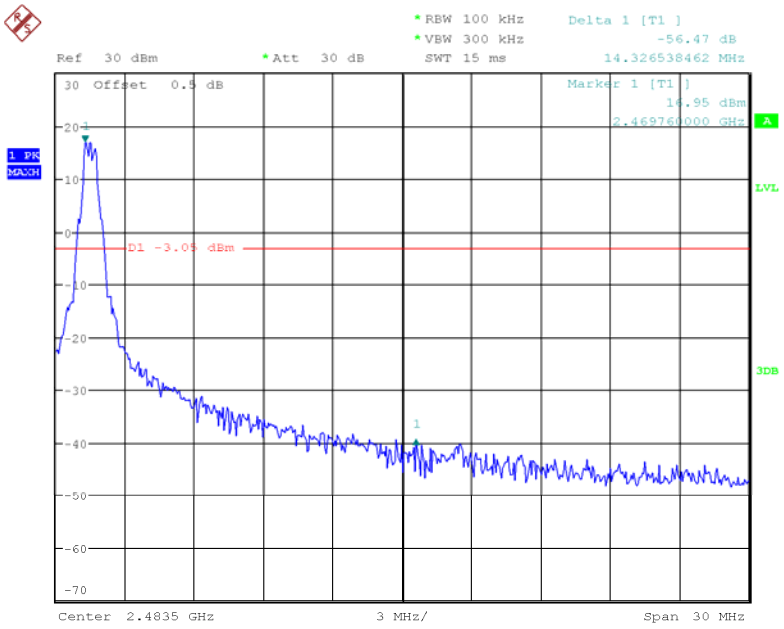
Test Result: Compliance

Single Channel Mode,
Chain 1:

Band Edge, Left Side



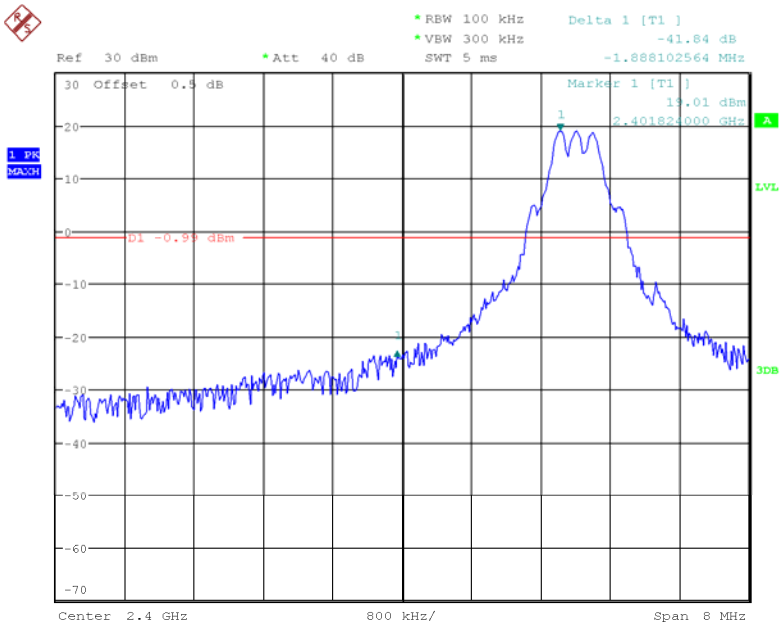
Band Edge, Right Side



Date: 6.JAN.2020 16:31:32

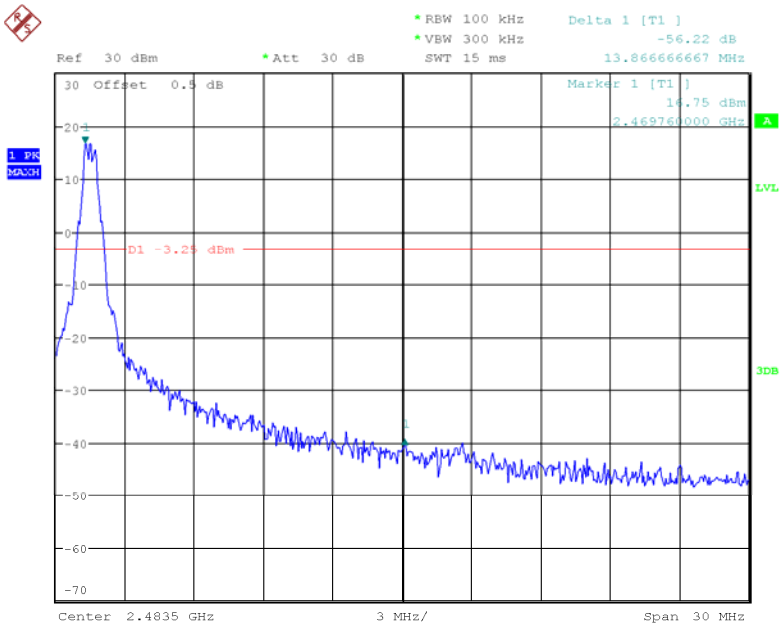
Chain 2:

Band Edge, Left Side



Date: 25.DEC.2019 09:52:51

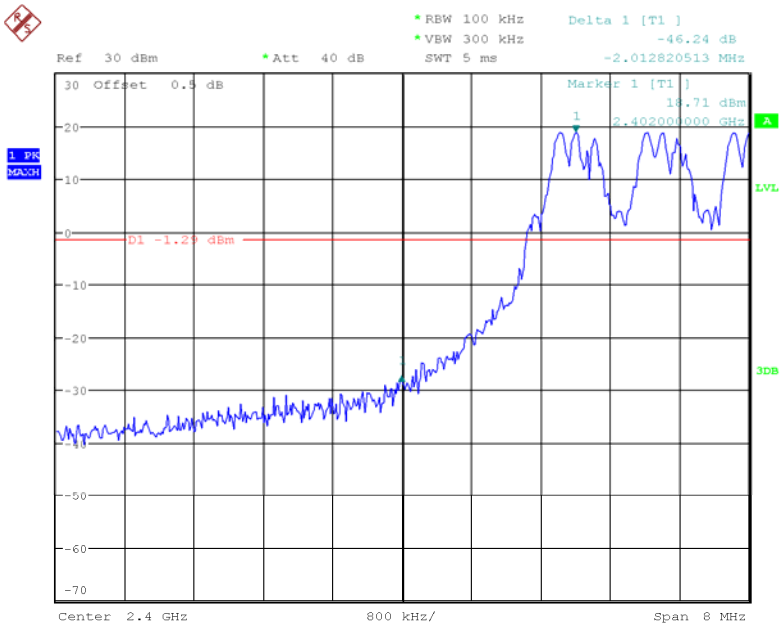
Band Edge, Right Side



Date: 6.JAN.2020 16:53:41

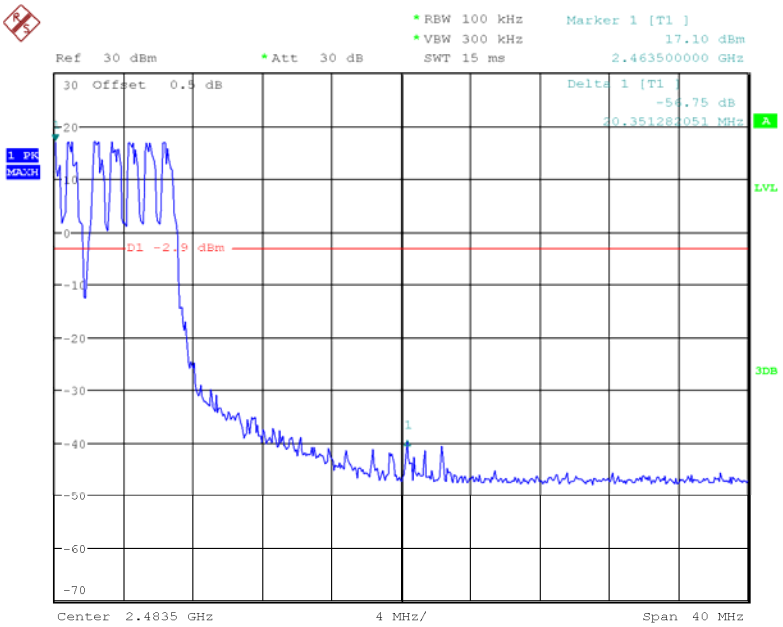
Hopping Mode,
Chain 1:

Band Edge, Left Side



Date: 25.DEC.2019 10:11:49

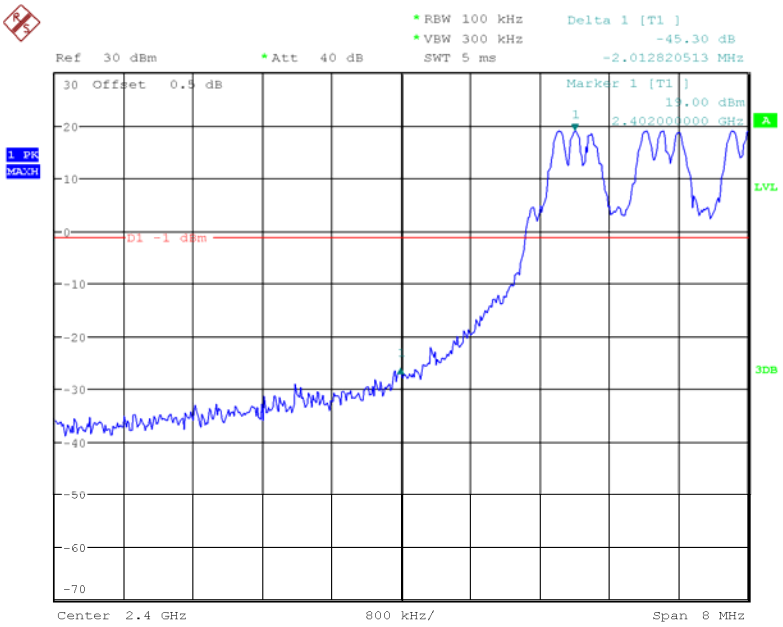
Band Edge, Right Side



Date: 6.JAN.2020 16:35:48

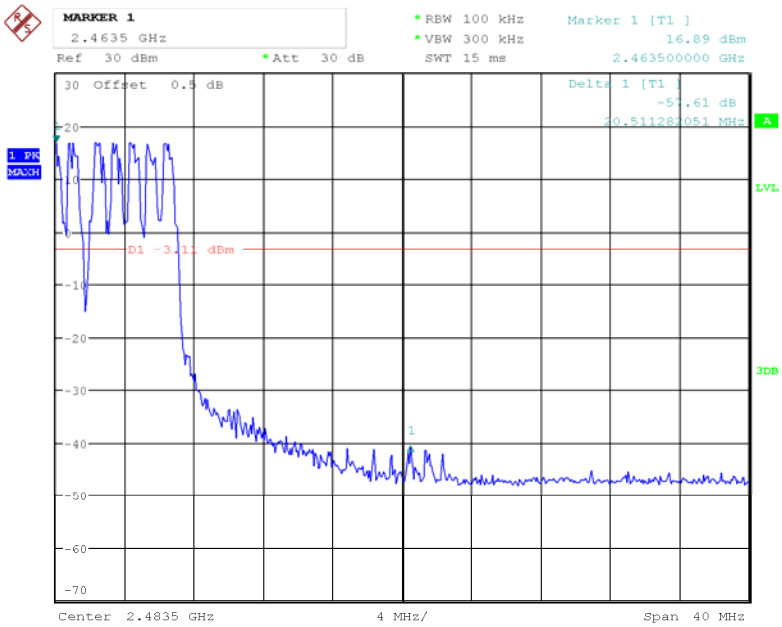
Chain 2:

Band Edge, Left Side



Date: 25.DEC.2019 09:44:40

Band Edge, Right Side



Date: 6.JAN.2020 16:52:12

******* END OF REPORT *******